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(71) Applicant
Siemens Aktiengesellschaft (FR Germany),
Berlin and Munich, Federal Republic of Germany

(72) Inventor
Albert Bauer

(74) Agent and/or Address for Service
Haseltine Lake & Co.
Hazlitt House, 28 Southampton Buildings, Chancery Lane, London WC2A 1AT

(54) Flexible electrical power transmission cable with profiled core having built-in tensile element

(57) A flexible electrical power transmission cable has a profiled core 7, 13 with a built-in elongate tensile load-bearing element 11, conductors 1, 2, 3 stranded around the core so as to define filler spaces, and elongate stranding elements 4, 5, 6. The profiled core 13 may have a built-in tensile load bearing element which may comprise an electrical conductor 14, the cladding 15 being insulating rubber. Alternatively a plastics thread may be located within core 13. The stranding elements 4, 5 may comprise protective conductors and be surrounded conductive rubber. The element 6 may comprise optical fibres. The conductors 1, 2 and 3 are surrounded by conductive rubber.

FIG 1

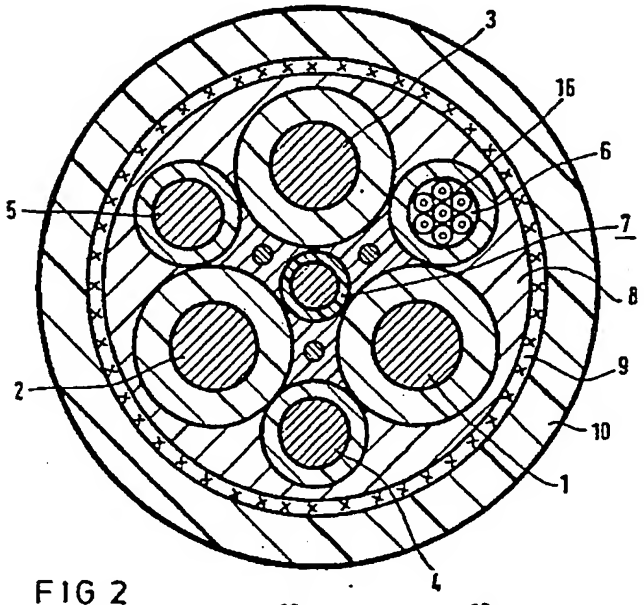

FIG 2

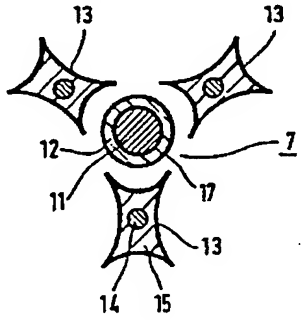

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FIG 1

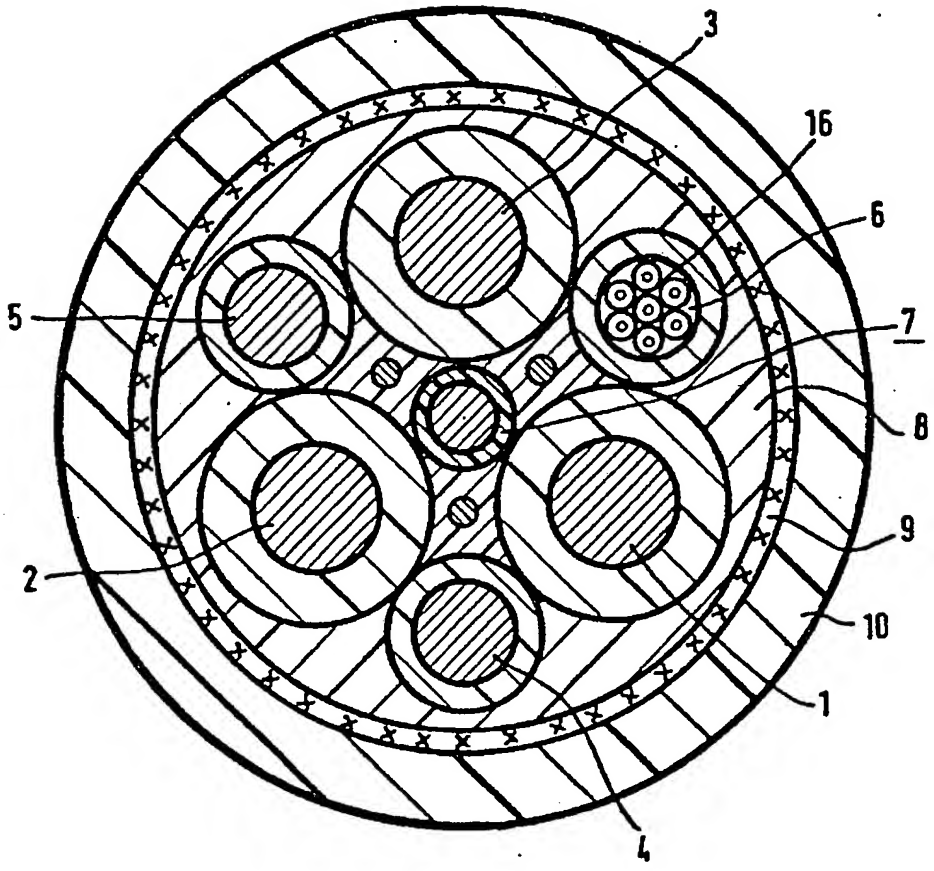
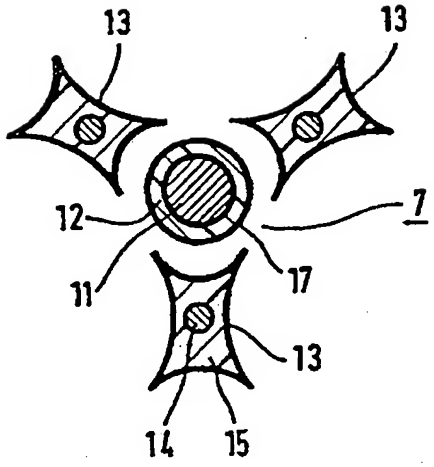


FIG 2



SPECIFICATION

Flexible electrical power transmission cable

This invention relates to a flexible electrical power transmission cable.

The invention has been developed primarily with a view to providing an improved construction of profiled core in a flexible electrical power transmission cable such as is used, for example, in the structural arrangement of heavy duty rubber tubular pipes for mechanically stabilising the cable.

In the structural design of unsteady, therefore compulsory guided rubber tubular pipes, it is usual to strand the wires of the cable around a profiled core, with which the wires are fixed in their spatial position with respect to one another, so that the mechanical stability of the cable is improved. The use of a profiled core is usual in particular with four-wired cables in which a protective conductor forms the fourth wire with its complete electrical cross section. When the cable is exposed to particular tensile stresses, a carrier element, for example a steel cable, can be arranged in the profiled core (DER ELEKTRIKER 11/77, page 285, "der elektromeister" 11/79, page 933).

The use of a profiled core is also known for power transmission cables in which three current-carrying wires form the actual stranded band of the cable, and in which further stranding elements are arranged in the filler spaces of these wires. In a known trailing cable the protective conductor is divided into two stranding elements, whilst a third stranding element is formed of two surrounding auxiliary wires stranded together and with a round jacket (circular sleeve) (DE-AS 10 28 644). In a mining cable that is also known the protective conductor is divided into three. The three wires of the protective conductor and the three current-carrying wires are stranded around a profiled core that is three-armed in cross section, which has outer surfaces curved inwardly in a circle corresponding to the wires, and contains in the centre a pilot wire. By the use of nylon yarn the pilot wire has a certain tensile strength. To increase the tensile strength of the cable as a whole there is arranged between the inner and outer jacket a plait of nylon threads (US-PS 4 002 820).

In order to adapt heavy rubber tubular pipes to newer developments in the field of signal transmissions, it is also known to arrange in the outer filler of such a cable a stranding element which contains optical transmission elements (DE-OS 28 01 231).

When a profiled core is used in a cable (having a built-in tensile elongate load bearing element e.g. a steel wire, for the cable in the core), it can prove difficult on some occasions to twist the elongate element in accordance with the stranding pitch of the other components of the cable.

The present invention has therefore been developed with a view to providing a flexible electrical power transmisission cable having a profiled core with a built-in elongate tensile load bearing element, and conductor lines stranded around the core, in which the core can readily be incorporated in the cable during stranding together of the components of the cable while still enabling secure assembly of the components in the cable.

According to the invention there is provided a flexible electrical power transmission cable having a profiled core with a built-in elongate tensile load-bearing element, conductors stranded around said core as to define filler spaces, and elongate stranding elements stranded around said core and occupying said filler spaces, in which:

the profiled core comprises a central circular core portion in which is located said elongate tensile load-bearing element, and a plurality of profiled core portions radially spaced from said central core portion and engaging with said conductors, said elongate stranding elements and said central core portion to form a secure core assembly; and

each profiled core portion has a four sided profile with the sides thereof being inwardly curved to engage with respective contact surfaces of the central core portion, the conductors and the elongate stranding elements.

Therefore, in the formation of a cable according to the invention, it is possible for the elongate tensile load bearing element to pass through a cable stranding process without being subjected to twisting. Thus, only the radially spaced profiled core portions are stranded which, since they are made of resilient material e.g. rubber, do not exhibit any notable resistance to mechanical deformation.

By forming the profiled core from a central circular core portion which is provided with the tensile load bearing element e.g. a steel wire, and a number (preferably three) of profiled core portions radially spaced therefrom, it is possible to embed or build-in into the profiled core portions tension resistance elements, such as production aids, and/or electrical conductors. The profiled core portions can at the same time therefore incorporate a wire which is to be used for control or monitoring purposes.

In a preferred embodiment, which is particularly suitable for three wire high voltage lines, there is disposed in one of the filler spaces defined around the core by the conductors a stranding element for signal and/or control purposes e.g. a stranding element comprising optical transmission elements, and the necessary protective conductor is then divided-up into the remaining two filler spaces. In this case, the three current carrying wires (conductors) are moved so far away from each other by a corresponding dimen-

sioning of the profiled core that the three stranding elements arranged in the filler spaces lie inside a circumferential circle defined by the three conductors.

One embodiment of flexible electrical power transmission cable according to the invention will now be described in detail, by way of example only, with reference to the accompanying drawing, in which:

Figure 1 is a cross-sectional view of the cable; and

Figure 2 illustrates a core portion of the cable.

Referring now to the drawing, there is shown a flexible electrical power transmission cable which comprises a heavy duty rubber tubular pipe for the current supply of the drive units of a lifting appliance. The cable consists of three current carrying conductor lines or wires 1,2 and 3, which, together with elongate stranding elements 4,5 and 6, are stranded around a profiled core 7 to form the cable core.

The stranded assembly as a whole is surrounded by an inner jacket or sheath 8, a plait 9 and an outer jacket or sheath 10. The stranding elements 4,5 and 6 occupy the filler spaces defined by the conductor wires 1, 2 and 3, and the stranding elements 4 and 5 comprise the halved portions of a protective conductor whilst the stranding element 6 contains optical transmission elements 16 so that it can function for signal or control purposes. The stranding element 6 may be constructed in similar manner to that disclosed for the stranding element known from DE-OS 28 01 231.

Referring now to Fig. 2, the construction of the core portion of the cable is shown more clearly. The core portion is designated generally by reference 7, and comprises a central circular core portion 17 in which is located an elongate tensile load-bearing element 11 which forms the main load carrying element for the cable. Conveniently, the element 11 comprises a steel wire. The profiled core also comprises three profiled core portions 13 which are radially spaced from the central core portion 17 and engage with the conductor wires 1,2,3, the elongate stranding elements 4,5,6 and the central core portion 17 to form a secure core assembly.

The central core portion 17 has a rubber cover 12 which surrounds the steel wire 11.

Each profiled core portion 13 has a four sided profile with the sides thereof being inwardly curved to engage with respective contact surfaces of the central core portion 17, the conductor wires 1,2,3 and the elongate stranding elements 4,5,6. The radially innermost side of each profiled core portion 12 engages with a contact surface of the central core portion 17, and the radially outermost side engages with the contact surface of one of the stranding elements 4,5,6. The remaining two curved sides of each profiled core portion 13, which are the longer sides, engage with the adjacent contact surfaces of a pair of the conductor wires 1,2,3 which embrace the core portion 13 therebetween.

The curvature of the sides of the profiled core portions 13 match the curvatures of the respective contact surfaces which they engage. Thus, the curvature of the longer sides are adapted to the curvature of the conductor wires, the curvature of the radially inner side corresponds to the curvature of the central core portion 17 which contains the steel wire 11, whereas the curvature of the radially outermost side is adapted to the curvature of the stranding element 4 to 6.

Each of the profiled core portions may have a built-in tensile load bearing element. This element may, or not, as desired comprise an electrical conductor 14 embedded therein. A cladding of insulating rubber 15 can surround each of the conductors 14 so as to form insulation therefor. Insulating conductors can also be embedded in the profiled core portions, in which case the core portion can be formed of electrically conductive rubber.

In the case in which the profiled core portions 13 do not contain any electrical conductor, it is recommended to embed a tension resistant element, for example a tension proof plastics thread, which during stranding of the profiled core portions absorbs any tensile stresses generated.

The cable shown in Fig. 1 is a high voltage cable, in which case the conductor wires 1,2, and 3 will be provided with an outer conductive rubber layer, though this is not shown in detail. Wires provided in the stranding elements 4 and 5, comprising the protective conductor, are also provided with a conductive rubber layer, as also is the stranding element 6.

CLAIMS

1. A flexible electrical power transmission cable having a profiled core with a built-in elongate tensile load-bearing element, conductors stranded around said core as to define filler spaces, and elongate stranding elements stranded around said core and occupying said filler spaces, in which:

the profiled core comprises a central circular core portion in which is located said elongate tensile load-bearing element, and a plurality of profiled core portions radially spaced from said central core portion and engaging with said conductors, said elongate stranding elements and said central core portion to form a secure core assembly; and

each profiled core portion has a four sided profile with the sides thereof being inwardly curved to engage with respective contact surfaces of the central core portion, the conductors and the elongate stranding elements.

2. A cable according to claim 1, in which

there are three conductors, three elongate stranding elements and three profiled core portions.

3. A cable according to claim 1 or 2, in which each profiled core portion contains a respective tensile load bearing element.

4. A cable according to any one of the preceding claims, in which one or more of said profiled core portions contains a respective electrical conductor.

5. A cable according to claim 2, or claims 3 or 4 when appendant to claim 2, in which two of said elongate stranding elements comprise halved protective conductors and the third elongate stranding element comprises optical transmission elements.

6. A cable according to any one of the preceding claims, in which the built-in elongate tensile load bearing element in the profiled core comprises a steel wire.

7. A cable according to claim 1 and substantially as hereinbefore described with reference to, and as shown in the accompanying drawings.

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